

CLAIMS

What is claimed is:

- 1 1. A process for manufacturing a coil structure for a magnetic head, comprising:
2 depositing an insulating layer;
3 depositing a photoresist layer on the insulating layer;
4 depositing a silicon dielectric layer on the photoresist layer;
5 masking the silicon dielectric layer;
6 reactive ion etching at least one channel in the silicon dielectric layer;
7 reactive ion etching at least one channel in the photoresist layer and the silicon
8 dielectric layer, wherein the channel includes a first segment defining a first angle and a
9 second segment defining a second angle;
10 depositing a conductive seed layer in the channel;
11 filling the channel with a conductive material to define a coil structure; and
12 chemical-mechanical polishing the conductive material and the conductive seed
13 layer for the planarizing thereof.
- 1 2. The process as recited in claim 1, wherein the first segment of the channel is
2 positioned below the second segment of the channel.
- 1 3. The process as recited in claim 2, wherein the first segment defines a beveled
2 angle.

- 1 4. The process as recited in claim 3, wherein the first segment defines an angle
2 between 70 and 85 degrees.
- 1 5. The process as recited in claim 2, wherein the second segment defines an angle
2 that is substantially vertical.
- 1 6. The process as recited in claim 5, wherein the second segment defines an angle
2 between 80 and 90 degrees.
- 1 7. The process as recited in claim 6, wherein the first segment defines an angle
2 between 70 and 85 degrees.
- 1 8. The process as recited in claim 1, wherein the reactive ion etching includes
2 $\text{H}_2/\text{N}_2/\text{CH}_3\text{F}/\text{C}_2\text{H}_4$ reducing chemistry.
- 1 9. The process as recited in claim 8, wherein the reducing chemistry includes
2 $\text{H}_2/\text{N}_2/\text{CH}_3\text{F}/\text{C}_2\text{H}_4$ gas ratios of 50-100/100-200/1-3/1-10.
- 1 10. The process as recited in claim 8, wherein the reducing chemistry includes a
2 pressure range of 5 to 20mTorr.

- 1 11. The process as recited in claim 8, wherein the reducing chemistry includes a
2 temperature range of -30 to 0°C.
- 1 12. The process as recited in claim 8, wherein the reactive ion etching is carried out
2 by an inductively coupled plasma system with a coil power including 900 to 1500
3 watts.
- 1 13. The process as recited in claim 1, wherein the reactive ion etching is carried out
2 by an inductively coupled plasma system with a radio frequency (RF) power
3 including 100 to 200 watts.
- 1 14. The process as recited in claim 1, wherein the reactive ion etching is carried out
2 by an inductively coupled plasma system with a magnitude of a radio frequency
3 (RF) bias including about 120V.
- 1 15. The process as recited in claim 1, wherein the photoresist is hard-baked.
- 1 16. The process as recited in claim 1, wherein the conductive seed layer includes at
2 least one of Cu, Ta, and TaN.
- 1 17. The process as recited in claim 1, wherein the conductive material includes Cu.

- 1 18. The process as recited in claim 1, wherein the silicon dielectric layer includes at
2 least one of SiO_2 and Si_3N_4 .
- 1 19. The process as recited in claim 1, wherein an aspect ratio of the channel is at least
2 2.5.
- 1 20. The process as recited in claim 1, wherein the masking includes depositing
2 another photoresist layer including an imaging photoresist layer.
- 1 21. The process as recited in claim 1, and further comprising removing at least part of
2 the silicon dielectric layer.
- 1 22. The process as recited in claim 21, wherein the silicon dielectric layer is removed
2 by chemical-mechanical polishing (CMP).
- 1 23. The process as recited in claim 1, and further comprising depositing an adhesion
2 promoter layer between the silicon dielectric layer and the imaging photoresist
3 layer.
- 1 24. The process as recited in claim 1, wherein the reactive ion etching includes
2 CF_4/CHF_3 chemistry.

1 25. A magnetic head, comprising:
2 an insulating layer;
3 a photoresist layer positioned adjacent the insulating layer for defining at least one
4 channel; and
5 a coil structure defined by a conductive material situated in the channel;
6 wherein a profile of the channel includes a first segment defining a first angle and
7 a second segment defining a second angle.

1 26. The magnetic head as recited in claim 25, wherein the first segment of the channel
2 is positioned below the second segment of the channel.

1 27. The magnetic head as recited in claim 26, wherein the first segment defines a
2 beveled angle.

1 28. The magnetic head as recited in claim 27, wherein the first segment defines an
2 angle between 70 and 85 degrees.

1 29. The magnetic head as recited in claim 26, wherein the second segment defines an
2 angle that is substantially vertical.

- 1 30. The magnetic head as recited in claim 29, wherein the second segment defines an
2 angle between 80 and 90 degrees.
- 1 31. The magnetic head as recited in claim 30, wherein the first segment defines an
2 angle between 70 and 85 degrees.
- 1 32. The magnetic head as recited in claim 25, wherein the reactive ion etching
2 includes $H_2/N_2/CH_3F/C_2H_4$ reducing chemistry.
- 1 33. The magnetic head as recited in claim 25, wherein the photoresist is hard-baked.
- 1 34. The magnetic head as recited in claim 25, wherein the conductive material
2 includes Cu.
- 1 35. The magnetic head as recited in claim 25, wherein an aspect ratio of the channel
2 and coil structure is at least 2.5.
- 1 36. A magnetic head manufactured utilizing a process, comprising:
2 depositing an insulating layer;
3 depositing a photoresist layer on the insulating layer;
4 depositing a silicon dielectric layer on the photoresist layer;
5 masking the silicon dielectric layer;

6 reactive ion etching a plurality of channels in the silicon dielectric layer using
7 CF_4/CHF_3 chemistry;
8 reactive ion etching a plurality of channels in the photoresist layer and the silicon
9 dielectric layer, wherein the channels each include a first segment defining a first angle
10 and a second segment defining a second angle, wherein a $\text{H}_2/\text{N}_2/\text{CH}_3\text{F}/\text{C}_2\text{H}_4$ reducing
11 chemistry is utilized in channel formation;
12 depositing a conductive seed layer in the channels;
13 electroplating the channels with a conductive material to define a coil structure;
14 and
15 chemical-mechanical polishing the conductive material and the conductive seed
16 layer for the planarizing thereof.

1 37. A disk drive system, comprising:
2 a magnetic recording disk;
3 a magnetic head including:
4 an insulating layer,
5 a photoresist layer positioned adjacent the insulating layer for defining at
6 least channel, and
7 a coil structure defined by a conductive material situated in the channel,
8 wherein the channel and coil structure include a first segment defining a
9 first angle and a second segment defining a second angle;

- 10 an actuator for moving the magnetic head across the magnetic recording disk so
- 11 the magnetic head may access different regions of the magnetic recording disk; and
- 12 a controller electrically coupled to the magnetic head.